

U.S. Serial No. 10/697,370
Amendment Dated January 18, 2005
Response To Office Action Dated October 18, 2004

REMARKS

The pending application was filed on October 30, 2003 with claims 1-20. The Examiner issued a Non-Final Office Action dated October 18, 2004 rejecting claims 1, 5-12, and 16-20 and objecting to claims 2-4 and 13-15 while indicating that the claims 2-4 and 13-15 would be allowable if rewritten in independent form including all of the claim limitations of the base claim and any intervening claims. In particular, the Examiner rejected claims 1, 6-9, and 11 under 35 U.S.C. §102(e) as being anticipated, and therefore unpatentable, in view of United States Published Application No. 2004/0022630 to *Tiemann*, rejected claims 1 and 7-9 under 35 U.S.C. §102(b) as being anticipated by United States Patent No. 5,511,309 to *Beabout*, and rejected claims 1, 6-7, and 9-10 under 35 U.S.C. §102(b) as being anticipated by United States Patent No. 3,799,696 to *Redman*. The Examiner also rejected claims 1, 6-7, and 9-10 under 35 U.S.C. §103(a) as being unpatentable over United States Patent No. 3,528,751 to *Quinones* in view of United States Patent No. 3,799,696 to *Redman* and rejected claims 5, 12, 16-18, and 20 under 35 U.S.C. §103(a) as being unpatentable over United States Published Application No. 2004/0022630 to *Tiemann* in view of United States Patent No. 5,120,192 to *Ohtomo*.

Claims 1-20 remain pending in the patent application. In view of the arguments set forth below, claims 1-20 are allowable, and the Examiner is respectfully requested to withdraw the rejections and issue a Notice of Allowance.

{WP213679;1}

U.S. Serial No. 10/697,370
Amendment Dated January 18, 2005
Response To Office Action Dated October 18, 2004

I. DRAWINGS

The Examiner indicated that the drawings fail to comply with 37 CFR 1.84 (p)(5) because they include reference no. "66" in Figure 2 that is not mentioned in the specification. The Examiner requested that appropriate correction be made. The Examiner is respectfully requested to review page 6, line 13 of the specification as originally filed, where reference no. "66" is discussed. In view of this recitation in the specification, submission of replacement sheets should not be required, and the Examiner is respectfully requested to withdraw the objection.

II. SPECIFICATION

The Examiner requested that numerous corrections be made to the specification. All requested corrections have been made on pages 3-5 above.

III. EXAMINER'S SUGGESTION REGARDING CLAIM LANGUAGE

The Examiner suggested that in claim 1, line 22 and in claim 12, line 24 the word "a" be changed to "the." Appropriate correction has been made to claims 1 and 12 in agreement with the Examiner's suggestion.

U.S. Serial No. 10/697,370
Amendment Dated January 18, 2005
Response To Office Action Dated October 18, 2004

IV. CLAIM REJECTIONS UNDER 35 U.S.C. §112

The Examiner rejected claims 12-20 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that the applicant regards as the invention. In particular, the Examiner stated that claim 12, line 21 recites "at least one metering orifice," while claim 12, line 22 recites "each of the plurality of metering orifices." Claims 12 and 20 have been amended to recite "at least one metering orifice" consistently throughout. Thus, claim 12 and those claims depending therefrom are patentable, and the Examiner is respectfully requested to withdraw the rejection.

V. REJECTION OF CLAIMS 1, 6-9, AND 11 UNDER 35 U.S.C. §102(e)

The Examiner rejected claims 1, 6-9, and 11 under 35 U.S.C. §102(e) as being anticipated, and therefore unpatentable, in view United States Published Application No. 2004/0022630 to *Tiemann*. The Examiner stated that *Tiemann* discloses a turbine vane having all of the claimed elements. The Examiner also argued that the phrases "adapted to be coupled to a shroud assembly" and "adapted to be coupled to a manifold assembly" are recitations of intended use.

Claim 1 is directed, in relevant part, to a turbine vane comprising "a generally elongated hollow airfoil having . . . a first end adapted to be coupled to a shroud assembly . . . a serpentine cooling path formed from at least a first inflow section and a first outflow

{WP213679;1}

U.S. Serial No. 10/697,370
Amendment Dated January 18, 2005
Response To Office Action Dated October 18, 2004

section . . . [and] at least one inlet orifice in the first inflow section of the serpentine cooling path at the first end of the generally elongated hollow airfoil" (emphasis added). Thus, the first inflow section of the serpentine cooling channel includes at least one orifice at the first end of the airfoil. In stark contrast, the cooling system disclosed in *Tiemann* does not include an inlet at the end of the airfoil adapted to be coupled to a shroud assembly. Rather, the inflow section of the serpentine cooling path at the first end shown in Figure 1 of *Tiemann* is sealed, as shown in close proximity to identification numeral 43 in Figure 1 of *Tiemann*. Thus, for at least this reason, claim 1 is not anticipated by *Tiemann*, and the Examiner is respectfully requested to withdraw his rejection of claims 1, 6-9 and 11.

VI. REJECTION OF CLAIMS 1 AND 7-9 UNDER 35 U.S.C. §102(b)

The Examiner rejected claims 1 and 7-9 under 35 U.S.C. §102(b) as being anticipated by United States Patent No. 5,511,309 to *Beabout*. The Examiner stated that *Beabout* discloses a turbine vane having all of the claimed elements. The Examiner also argued that the phrases "adapted to be coupled to a shroud assembly" and "adapted to be coupled to a manifold assembly" are recitations of intended use.

Claim 1 is directed, in relevant part, to a turbine vane comprising "a generally elongated hollow airfoil . . . [and] at least one metering rib defining a barrier between a portion of the first inflow section and the at least one leading edge cooling path, wherein the at least one metering rib includes at least one metering orifice; and wherein the at least one metering orifice in the metering rib is sized to regulate flow of cooling fluids through the at

{WP213679;1}

U.S. Serial No. 10/697,370
Amendment Dated January 18, 2005
Response To Office Action Dated October 18, 2004

least one leading edge cooling path and into the manifold assembly" (emphasis added). In contrast, the airfoil cooling system disclosed in *Beabout* does not anticipate claim 1 or any claim dependent therefrom. Specifically, *Beabout* does not disclose a metering rib defining a barrier between the first inflow channel of the serpentine channel and the leading edge cooling path, where the metering rib includes at least one metering orifice. Rather, *Beabout* simply discloses a rib separating a serpentine channel from leading edge channel. However, no metering orifices are shown in the rib disclosed in *Beabout*. Thus, for at least this reason, claim 1 is not anticipated by *Beabout*, and the Examiner is respectfully requested to withdraw his rejection of claims 1 and 7-9.

VII. REJECTION OF CLAIMS 1, 6-7, AND 9-10 UNDER 35 U.S.C. §102(b)

The Examiner rejected claims 1, 6-7, and 9-10 under 35 U.S.C. §102(b) as being anticipated by United States Patent No. 3,799,696 to *Redman*. The Examiner stated that *Redman* discloses a turbine vane having all of the claimed elements. The Examiner also argued that the phrases "adapted to be coupled to a shroud assembly" and "adapted to be coupled to a manifold assembly" are recitations of intended use.

Claim 1 is directed to a turbine vane comprising "a generally elongated hollow airfoil . . . a serpentine cooling path formed from at least a first inflow section and a first outflow section . . . at least one leading edge cooling path positioned proximate to the leading edge . . . at least one metering rib defining a barrier between a portion of the first inflow section and

{WP213679;1}

U.S. Serial No. 10/697,370
Amendment Dated January 18, 2005
Response To Office Action Dated October 18, 2004

the at least one leading edge cooling path, wherein the at least one metering rib includes at least one metering orifice; and wherein the at least one metering orifice in the metering rib is sized to regulate flow of cooling fluids through the at least one leading edge cooling path and into the manifold assembly" (emphasis added). In stark contrast, *Redman* does not disclose a metering rib defining a barrier between a serpentine channel and a leading edge cooling path. The Examiner cites element 39 of *Redman* as being a metering rib forming a barrier. However, element 39 is described as an air entry tube at column 3, line 44 in *Redman*. Element 38 of *Redman* appears to form a barrier separating a serpentine cooling channel from another cooling channel. In contrast, element 38 is defined in *Redman* as being a diaphragm dividing leading and trailing sections at column 3, lines 32 and 33. However, *Redman* does not disclose metering holes in the diaphragm 38. Thus, for at least this reason, claim 1 is not anticipated by *Redman*, and the Examiner is respectfully requested to withdraw his rejection of claims 1, 6-7, and 9-10.

VIII. REJECTION OF CLAIMS 1, 6-7, AND 9-10 UNDER 35 U.S.C. §103(a)

The Examiner rejected claims 1, 6-7, and 9-10 under 35 U.S.C. §103(a) as being unpatentable over United States Patent No. 3,528,751 to *Quinones* in view of United States Patent No. 3,799,696 to *Redman*. The Examiner stated that *Quinones* discloses a turbine vane having all of the claimed elements. However, the Examiner admitted that *Quinones* does not disclose an inlet orifice near the first end of the inflow section of the serpentine

{WP213679:1}

U.S. Serial No. 10/697,370
Amendment Dated January 18, 2005
Response To Office Action Dated October 18, 2004

cooling path. In addition, the Examiner admitted that *Quinones* does not disclose that the first inflow section of the serpentine cooling path is a convergent cooling path having a first cross-sectional area at a first end that is greater than a second cross-sectional area at the second end of the generally elongated hollow airfoil. Furthermore, the Examiner admitted that *Quinones* does not disclose that the metering orifices have different cross-sectional areas.

The Examiner stated that *Redman* discloses an inlet in a first convergent inflow section of a serpentine cooling path that is at a first outer end of an airfoil. The Examiner also stated that *Redman* discloses a plurality of metering orifices having different cross-sectional areas for the purpose of ensuring adequate vane cooling. The Examiner concluded that it have been obvious to one of ordinary skill in the art at the time the invention was made to form the vane of *Quinones* such that the orifice in the first inflow section of the serpentine cooling path is located at the first end of the generally elongated airfoil and that the first inflow section is convergent having a first cross-sectional area at a first end that is greater than a second cross-sectional area at a second end.

Quinones discloses a cooling system in an airfoil in which cooling fluids are admitted through an opening (55) positioned in a turn of a serpentine cooling channel at an end of the airfoil. The opposite end of the airfoil is sealed with end plate (53), as shown in Figure 3 and discussed at column 4, lines 25 -30. A radial partition (52) separates a leading edge chamber (50) from the serpentine cooling channel (51). However, the radial partition (52) does not include metering slots, as claimed in Claim 1 of the instant application. Rather, as discussed

{WP213679;1}

U.S. Serial No. 10/697,370
Amendment Dated January 18, 2005
Response To Office Action Dated October 18, 2004

at column 4, line 73 – column 5, line 2 and at column 5, lines 20-31 of *Quinones*, the radial partition (52) includes throttling holes (74), which are used for impingement cooling of the leading edge, not as metering holes. Thus, the cooling system disclosed in *Quinones* does not disclose the claimed turbine vane of claim 1 of the instant invention.

The Examiner argued that it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the invention disclosed in *Quinones* with the invention disclosed in *Redman*. However, as discussed above, such a combination does not disclose all elements of claim 1. In addition, the combination of *Quinones* and *Redman* would not have been obvious to one of ordinary skill in the art at the time the invention was made. *Redman* discloses an internally cooled turbine airfoil having a serpentine cooling channel with a leading edge cooling chamber. An inlet is positioned at a first end in the serpentine cooling channel opposite to the turn in the serpentine cooling channel, and a barrier exists between the leading edge cooling channel and the serpentine cooling channel. Cooling air is supplied to the leading edge cooling channel through channels other than the serpentine cooling channel. In contrast, *Quinones* discloses a serpentine cooling system having an air inlet in a first turn between inflow and outflow channels of the serpentine channel and a barrier positioned between the serpentine cooling channels and a leading edge channel that includes throttling holes.

To conclude that simply closing the cooling air inlet in the first turn of *Quinones* and replacing it with a cooling air inlet at the opposite end of the inflow channel of the serpentine

{WP213679;1}

U.S. Serial No. 10/697,370
Amendment Dated January 18, 2005
Response To Office Action Dated October 18, 2004

channel is impermissible hindsight. To alter the cooling scheme shown in *Quinones* would alter the cooling air pressures across the cooling system of *Quinones*. The cooling air admitted into the serpentine cooling channel enters directly into the inflow and outflow channels, thereby overcoming the pressure and friction losses associated with a turn in a serpentine cooling channel. Such a design does not account for such turn losses that would be created if the inlet location were to be moved as suggested by the Examiner. Claim 1 has also been amended to point out that the first turn of the serpentine cooling channel of the claimed invention is formed from a continuous wall to more closely define the invention. Therefore, it would not have been obvious to one of ordinary skill in the art at the time the invention was made to combine the cooling system shown in *Quinones* with the cooling system shown in *Redman*. Thus, for at least these reasons, claim 1 is patentable, and the Examiner is respectfully requested to withdraw the rejection.

Furthermore, neither *Quinones* nor *Redman* discloses metering slots have different cross-sectional areas, as claimed in claim 10 and it would not have been obvious at the time the invention was made to include metering slots having different cross-sectional areas. Furthermore, claim 10 depends indirectly from claim 1, which is patentable for the reasons set forth herein. Thus, claim 10 is patentable, and the Examiner is respectfully requested to withdraw the rejection.

U.S. Serial No. 10/697,370
Amendment Dated January 18, 2005
Response To Office Action Dated October 18, 2004

IX. REJECTION OF CLAIMS 5, 12, 16-20 UNDER 35 U.S.C. §103(a)

The Examiner rejected claims 5, 12, 16-18, and 20 under 35 U.S.C. §103(a) as being unpatentable over United States Published Application No. 2004/0022630 to *Tiemann* in view of United States Patent No. 5,120,192 to *Ohtomo*. The Examiner stated that *Tiemann* discloses the claimed invention. However, the Examiner admitted that *Tiemann* does not disclose that the leading edge cooling path is a divergent cooling path. The Examiner stated that *Ohtomo* discloses a divergent cooling path in figures 11 and 12.

As previously discussed in Section V, claim 1 is directed, in relevant part, to a turbine vane comprising "a generally elongated hollow airfoil having . . . a first end adapted to be coupled to a shroud assembly . . . a serpentine cooling path formed from at least a first inflow section and a first outflow section . . . [and] at least one inlet orifice in the first inflow section of the serpentine cooling path at the first end of the generally elongated hollow airfoil" (emphasis added). Thus, the first inflow section of the serpentine cooling channel includes at least one orifice at the first end of the airfoil. In stark contrast, the cooling system disclosed in *Tiemann* does not include an inlet at the end of the airfoil adapted to be coupled to a shroud assembly. Rather, the inflow section of the serpentine cooling path at the first end shown in Figure 1 of *Tiemann* is sealed, as shown in close proximity to identification numeral 43 in Figure 1 of *Tiemann*. Thus, for at least this reason, claim 1 is not rendered obvious by the combination of *Tiemann* and *Ohtomo*, and the Examiner is respectfully requested to withdraw his rejection of claims 1, 6-9 and 11.

{WP213679;1}

U.S. Serial No. 10/697,370
Amendment Dated January 18, 2005
Response To Office Action Dated October 18, 2004

The Examiner rejected claim 19 under 35 U.S.C. §103(a) as being unpatentable over United States Published Application No. 2004/0022630 to *Tiemann* in view of United States Patent No. 5,120,192 to *Ohtomo*, further in view of *Redman*. Claim 19 depends indirectly from claim 12, which is patentable for the reasons set forth herein. Therefore, claim 19 is patentable as well, and the Examiner is respectfully requested to withdraw the rejection.

U.S. Serial No. 10/697,370
Amendment Dated January 18, 2005
Response To Office Action Dated October 18, 2004

CONCLUSION

For at least the reasons given above, claims 1-20 define patentable subject matter and are thus allowable. The undersigned representative thanks the Examiner for examining this application.

Should the Examiner believe that anything further is necessary in order to place the application in better condition for allowance, the Examiner is respectfully requested to contact the undersigned representative at the telephone number listed below.

No fees are believed due; however, the Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, to Deposit Account No. 50-0951.

Respectfully submitted,



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